Inorganic and Organic Chemistry

RAFT POLYMERIZATION OF ACRYLAMIDO MONOMERS IN WATER

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RAFT polymerization is one in a group of polymerization methods known as Controlled Radical Polymerizations (CRP). The RAFT process uses a chain transfer agent (CTA) to control polymerization, and offers many benefits over other CRP methods. To date, most successful CTAs have been dithioesters. Recently, a new CTA (sodium 2-(2-thiobenzoylsulfonyl-propionylamino)-ethane sulfonate) was synthesized within the McCormick Research Laboratory at the University of Southern Mississippi that shows considerable promise in the controlled polymerization of acrylamido monomers in water. The small amount initially synthesized was used to polymerize the acrylamido monomers N,N-dimethylacrylamide (DMA), N-methylacrylamide, sodium-2-acrylamido-2-methylpropane sulfonate (AMPS), and N-[3-(dimethylamino)propyl]-acrylamide (DAPA) in aqueous media. The results indicate that the new CTA is successful in the controlled polymerization of the preceding monomers. These results led to a study of the effectiveness of the CTA at the controlled polymerization of N,N-dimethylacrylamide, N-methylacrylamide, and acrylamide at pH 2, pH 5, pH 7, and pH 8 to determine the optimal polymerization pH for the monomers in water. Before this study could be conducted, a scale-up synthesis of the CTA was done. The CTA synthesis proved unsuccessful, and only some of the target polymerizations could be conducted, due to a lack of CTA. N,N-Dimethylacrylamide and N-methylacrylamide were each polymerized at pH 5 and pH 7 and were then analyzed by gel permeation chromatography (GPC). Results show that the polymerization of N-methylacrylamide in solution of pH 7 lacks control, due to possible hydrolysis of the monomer and macro-CTA, but that the polymerization of N-methylacrylamide at pH 5 appears to be controlled. The polymerizations of DMA at pH 5 and pH 7 were both successfully controlled.